

## Understanding the Different Cost Measures of a Firm

### Part A: Different Meanings of the Word “Profit”

Economists assume the goal of a firm is to maximize its total profit. This sounds like an easy goal to understand, but the economist’s view of profit is different from that of an accountant. Let’s use a short story about Pat to illustrate the differences. First, we must define two categories of cost. An *explicit cost* is an expenditure by the firm; it could be a payment for items such as wages, rent, or advertising. An *implicit cost* is the opportunity cost of an entrepreneur using his/her own resource in the company.

An economic short story: Pat is a banker who earned an annual salary of \$50,000 last year. She invested a total of \$100,000 of her own money in various savings assets, which gave her interest income of \$6,000. Pat also owns a small building, which she leased to someone last year for \$14,000. But now Pat decides she wants to leave banking and set up her own landscaping company. Rather than borrowing money to buy new equipment, she uses her \$100,000 in savings to buy it. She also decides to stop leasing her building so she can use it for her new enterprise. In her first year of landscaping, Pat brings in total revenue of \$300,000. She spends \$220,000 for such things as her equipment, workers, supplies, and insurance.

1. An accountant defines total profit to be total revenue minus explicit costs. Pat’s *accounting profit* from her landscaping company is \$80,000 this year.

$$\text{Accounting profit} = \text{total revenue} - \text{explicit costs} = \$300,000 - \$220,000 = \$80,000.$$

2. In addition to explicit costs, an economist considers implicit costs as well. This year, Pat’s *economic profit* from her landscaping business is \$10,000.

$$\begin{aligned}\text{Economic profit} &= \text{total revenue} - (\text{explicit costs} + \text{implicit costs}) \\ &= \$300,000 - (\$220,000 + \$50,000 + \$6,000 + \$14,000) \\ &= \$300,000 - \$290,000 = \$10,000.\end{aligned}$$

3. Another type of profit is called *normal profit*. It recognizes that Pat should “pay herself” for using her resources in her own company. Her normal profit, which is equal to her implicit costs, indicates the income Pat’s resources would have earned had they been used in their best alternative occupations. Pat’s normal profit is \$70,000.

$$\text{Normal profit} = \$50,000 + \$6,000 + \$14,000 = \$70,000.$$

4. If Pat’s total revenue from her landscaping business is only \$280,000, what would be the values of the different measures of profit?

$$(A) \text{ Accounting profit} = \$60,000 \text{ (Accounting profit} = \$280,000 - \$220,000.)$$

$$(B) \text{ Economic profit} = \$-10,000 \text{ (Economic profit} = \$280,000 - \$290,000.)$$

$$(C) \text{ Normal profit} = \$70,000$$

### Part B: The Seven Measures of a Firm's Short-Run Costs

The Morton Boat Company produces the very popular Jazzy Johnboat, which is desired by many fishermen and fisherwomen. Assume the firm operates in the short run with a fixed amount of equipment (capital) and views labor as its only variable resource. If it wants to produce more output, it will add more units of labor to its stock of equipment. Of course, the firm will have to pay its workers and also the owners of its capital, which means its total cost will increase as it produces more boats. Table 3-3.1 defines the seven cost measures the Morton Boat Company must consider.



Table 3-3.1

#### The Seven Short-Run Cost Measures of a Firm

Cost measure	What it means	How to calculate it
Total fixed cost (TFC)	All costs that do not change when output changes. TFC is a constant amount at all Q levels.	TFC = total cost of all fixed factors of production $TFC = Q \times AFC$
Total variable cost (TVC)	All costs that do change when output changes. TVC gets bigger as Q increases because the firm needs more labor to make more output.	TVC = total cost of all variable factors of production $TVC = Q \times AVC$
Total cost (TC)	All costs at a given output level. TC is the sum of TFC and TVC. TC increases as the level of output increases.	$TC = TFC + TVC$ $TC = Q \times ATC$
Average fixed cost (AFC)	Fixed cost (capital cost) per unit of output. AFC always falls as Q rises since TFC is a constant value.	$AFC = TFC/Q$
Average variable cost (AVC)	Variable cost (labor cost) per unit of output. AVC falls at first, and then rises as Q increases.	$AVC = TVC/Q$
Average total cost (ATC)	Total cost per unit of output. It is the sum of AFC and AVC. ATC falls at first, and then rises as Q increases.	$ATC = TC/Q$ $ATC = AFC + AVC$
Marginal cost (MC)	Change in the firm's TC when it produces another unit of output. Also shows change in TVC from an extra unit of output. MC falls at first, and then rises as Q increases.	$MC = \Delta TC / \Delta Q$ $MC = \Delta TVC / \Delta Q$ because the only part of TC that changes when more Q is produced is TVC.

*Reminder:* The AVC curve is U-shaped (falls, then rises as  $Q$  increases) because its shape is the mirror image of the APP curve as shown in Activity 3-2. The MC curve also is U-shaped because it is the mirror image of the MPP curve. Refer back to Figure 3-2.5.

Table 3-3.2 is the cost spreadsheet for the Morton Boat Company. It has information on all seven short-run cost measures based on different  $Q$  levels of the firm.

5. Complete Table 3-3.2. Some of the data have been posted for you already.



Table 3-3.2

**The Seven Short-Run Cost Measures of the Morton Boat Company (daily data)**

Q boats per day	(1) TFC	(2) TVC	(3) TC = TFC + TVC	(4) AFC = TFC/Q	(5) AVC = TVC/Q	(6) ATC = TC/Q = AFC + AVC	(7) MC = $\Delta TC / \Delta Q$ = $\Delta TVC / \Delta Q$
0	\$300	\$0	\$300	—	—	—	—
1	\$300	\$700	\$1,000	\$300	\$700	\$1,000	\$700
2	\$300	\$1,300	\$1,600	\$150	\$650	\$800	\$600
3	\$300	\$1,800	\$2,100	\$100	\$600	\$700	\$500
4	\$300	\$2,400	\$2,700	\$75	\$600	\$675	\$600
5	\$300	\$3,100	\$3,400	\$60	\$620	\$680	\$700
6	\$300	\$3,840	\$4,140	\$50	\$640	\$690	\$740

6. What trend do you observe in the value of TFC as the level of  $Q$  is increased? How do you explain this trend?

*TFC does not change as  $Q$  increases. TFC represents costs that do not depend on  $Q$ .*

7. What trend do you observe in the value of TVC as the level of  $Q$  is increased? How do you explain this trend?

*TVC increases as  $Q$  increases. TVC represents costs of variable resources such as labor. Because the firm must add more variable resources to produce more output, TVC increases as  $Q$  increases. The changing slope of TVC reflects increasing marginal productivity (the slope of the TVC curve decreases) and diminishing marginal productivity (the slope of the TVC curve increases) of the variable resources.*

8. Compare the ATC value at any  $Q$  level with the MC value at the next  $Q$  level. What relationship do you see between ATC and MC?

*The relationship between ATC and MC can be expressed as follows:*

- (1) *If MC is greater than ATC, then ATC will increase.*
- (2) *If MC is equal to ATC, then ATC does not change and is at its minimum value.*
- (3) *If MC is less than ATC, then ATC will decrease.*

9. Compare the AVC value at any  $Q$  level with the MC value at the next  $Q$  level. What relationship do you see between AVC and MC?

*The relationship between AVC and MC can be expressed as follows:*

- (1) *If MC is greater than AVC, then AVC will increase.*
  - (2) *If MC is equal to AVC, then AVC does not change and is at its minimum value.*
  - (3) *If MC is less than AVC, then AVC will decrease.*
10. Compare the AFC value at any  $Q$  level with the MC value at the next  $Q$  level. What relationship do you see between AFC and MC?
- Because TFC does not change as  $Q$  increases, AFC always decreases as  $Q$  increases. There is no relationship between AFC and MC.*

### Part C: Graphing the Cost Functions of a Firm

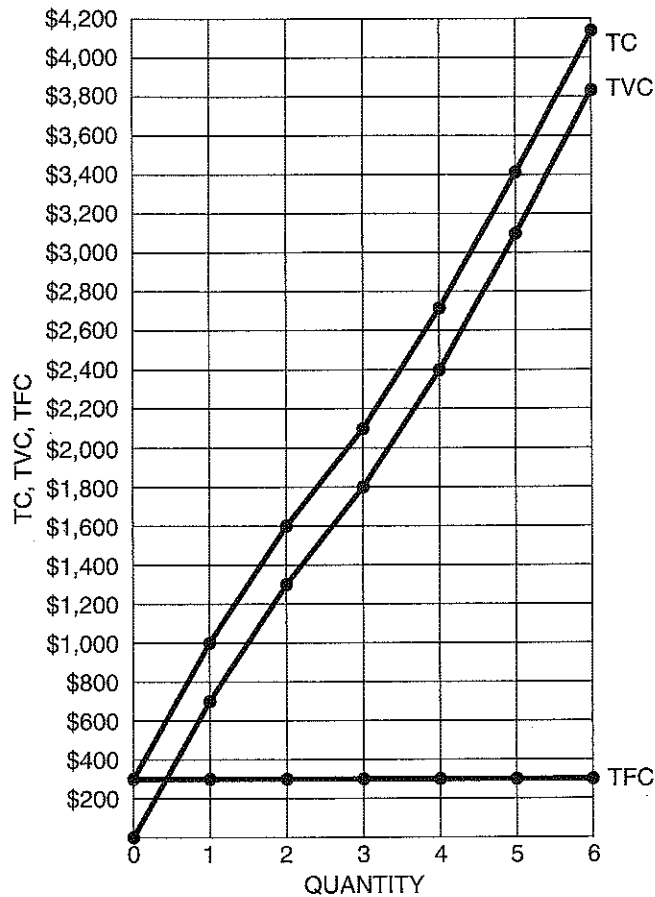
The relationships that exist among the firm's cost functions can be illustrated by plotting the data in Table 3-3.1 in cost graphs. Figure 3-3.1 is the "total" cost graph because it contains information about the firm's TC, TVC, and TFC functions. Figure 3-3.2 is the "marginal-average" cost graph because it shows the data for the firm's MC, ATC, AVC, and AFC functions.

11. Plot the data from Table 3-3.1 in the appropriate graphs. Two observations of TC and AVC have already been plotted for you.
12. Plot the values of MC at the new output level. For example, put a dot on the graph at the combination of  $Q = 4$  and  $MC = \$600$  since the MC resulting from producing the fourth boat is \$600. Connect the MC dots in your graph with a dotted line.



Figure 3-3.1

## The Firm's "Total" Cost Graph



13. Why is the vertical gap between the TC and TVC curves the same at all Q levels?

*That vertical gap is TFC, which has the same value at all Q levels.*

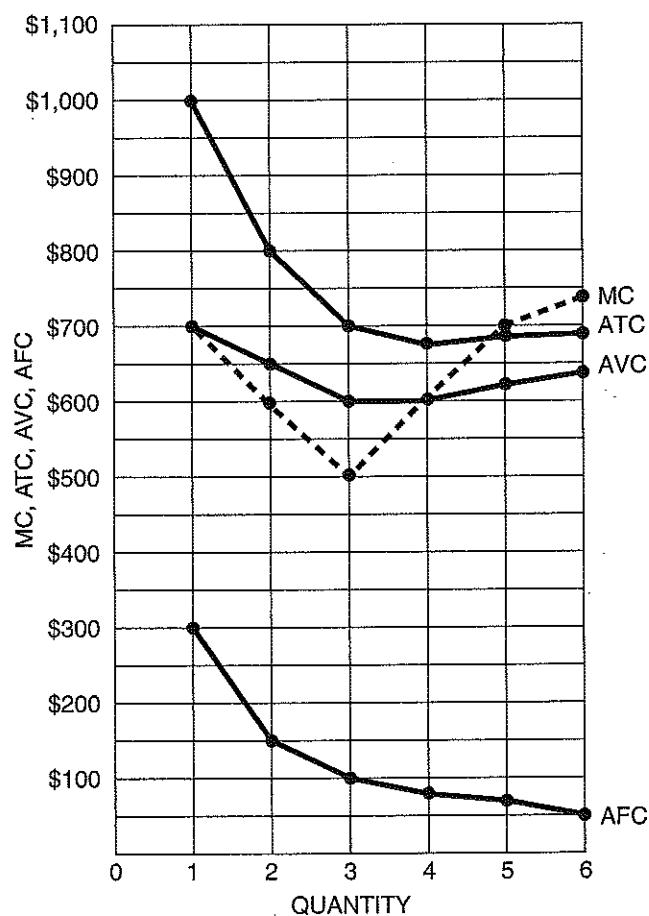
14. The slope of the TC curve can be expressed as  $\text{rise/run} = \Delta TC / \Delta Q$ . Do you know another cost function that is found using the ratio  $\Delta TC / \Delta Q$ ?

*The slope of the TC curve is equal to MC.*

15. Why do both the TC and TVC curves keep climbing higher and higher as the Morton Boat Company increases the number of boats it produces?  
*To produce more output, the firm must add more variable resources which means TVC increases as Q increases. Since  $TC = TVC + TFC$ , this means TC also increases as Q increases.*
16. Why does the TC curve not begin at the origin?  
*When the firm produces no output, it still has TFC. The TC curve intersects the vertical axis at the level of TFC.*



Figure 3-3.2  
The Firm's "Marginal-Average" Cost Graph



17. AVC continues to decrease as long as MC is (*greater than / equal to / less than*) AVC.
18. AVC continues to increase as long as MC is (*greater than / equal to / less than*) AVC.
19. ATC continues to decrease as long as MC is (*greater than / equal to / less than*) ATC.
20. ATC continues to increase as long as MC is (*greater than / equal to / less than*) ATC.
21. Mr. Burpin, your AP teacher, asks you to explain the following statement: "Average fixed cost falls as long as marginal cost is less than average fixed cost." What is your response?  
*AFC is not affected by whether MC is greater than or less than AFC. AFC always decreases as the firm produces more output.*
22. Do you agree with the following statement? "Average variable cost is minimized at the output level where marginal cost is equal to average variable cost." Explain.  
*Yes. When MC is below AVC, AVC decreases. When MC is above AVC, AVC increases. When MC is equal to AVC, AVC is at its minimum value.*
23. What do you say to someone who says, "Fixed cost is the same at all output levels"?  
*I would tell that person to be accurate when referring to fixed cost. TFC is the same at all output levels, but AFC decreases as Q increases.*
24. Can you tell from Table 3-3.1 how many boats the Morton Boat Company should produce to maximize its total profit? Explain.  
*No. We have no information about the revenue the firm receives from the sale of its boats. We will need revenue and cost data to determine the profit-maximizing number of boats.*